

■ Research Article

What Knowledge Management for Mobile Workers?

Mariano Corso^{1*}, Andrea Giacobbe¹, Antonella Martini²
and Luisa Pellegrini²

¹Department of Management, Economics and Industrial Engineering,
Politecnico di Milano, P.zza L. da Vinci, Milano, Italy

²Faculty of Engineering, Università di Pisa, Via Diotisalvi, Pisa, Italy

In today's global economy, many economic activities in and among firms are based on the contribution of workers that are mobile or work most of their time in geographically dispersed locations. In such environments, tools supporting Knowledge Management (KM) are essential, not only because of the advantage for business performance, but also because of their potential benefit in terms of people satisfaction and well being. Building on from the results of a 3-year field research survey in Italy, this paper explores: (i) the emerging approaches that companies use to manage knowledge in such dispersed environments; and (ii) their relations with Dispersed Workers (DW) Profiles (types and activities). Copyright © 2006 John Wiley & Sons, Ltd.

THE DISPERSED NATURE OF KNOWLEDGE AND WORKERS: CONTEXT AND LITERATURE

Leveraging on people's knowledge and creativity is a must in today's competitive business environment. The intensification of competition, however, forces companies to adopt new organizational models that seriously challenge traditional approaches to managing knowledge. Hence, this paper answers the need of empirically grounded research to draw implications of the systems supporting Knowledge Management (KM) within such new organizational models.

When analyzed in terms of how people are integrated and related to the rest of the organization, many companies are characterized by two trends:

- *Mobility and distribution of workforce*: Nowadays, the concept itself of the workplace is changing.

People spend an increasing amount of their working time outside the physical boundaries of their company, often in mobility and interacting with customers or people from partner organizations (Laubacher and Malone, 2003). Also when working inside the company, people often change positions and work in multi-disciplinary virtual teams. As a consequence, individuals have fewer and fewer opportunities for face-to-face interaction with their colleagues and can barely rely on their own experience.

- *Turnover and loose contractual links*: The provisional nature of employment, loose forms of contractual links to the company and high level of turnover (Drucker, 2002), while in many cases considered competitive needs, can make people's time with organizations temporary and partial, thus creating barriers to the sharing of knowledge and expertise among individuals.

These two factors converge to '*dispersed work*,' an operational definition introduced here. Dispersed work is work that is performed by different people in dynamic and changing situations where

*Correspondence to: Mariano Corso, Department of Management, Economics and Industrial Engineering, Politecnico di Milano, P.zza L. da Vinci, 32-20133, Milano, Italy.
E-mail: mariano.corso@polimi.it

collaboration and connectivity to shared resources is necessary, but not sufficient, for the successful completion of their common tasks. Being a successful 'Dispersed Worker' (DW) is in many cases a necessity rather than a choice that requires personal qualities such as independence and entrepreneurship that are far less fundamental in traditional organizations. With regard to professional growth and, in particular, access to knowledge, Dispersed Workers cannot simply rely on their companies' HR development policies. They must create growth opportunities and build a network of relationships that, in many cases, transcend the boundaries of the company.

Nowadays, DWs represent an increasingly relevant share of the total workforce (Drucker, 2002; Laubacher and Malone, 2003), and traditional management systems are not adequate, simply because they were not designed to answer their needs. Many management systems need to be revised, but the real essence of the change is probably related to Knowledge Management which becomes a fundamental need rather than a wish, for a two-fold reason:

- DWs' knowledge and experience are becoming a fundamental asset for the company: through proper management of this knowledge source, in both tacit and explicit forms, the company can, at least partly, appropriate this knowledge;
- a proper Knowledge Management System (KMS) can:
 - reconnect DW to the professional and social network of the company, preventing loss of knowledge;
 - provide them with opportunities for interaction and learning, thus supporting their job and their professional growth, long-term employability, ultimately improving job satisfaction and attractiveness.

When dealing with this issue, the biggest opportunities, but at the same time the biggest competitive challenges, are represented today by the availability of new ICT-enabled services, and in particular web applications and mobile Value Added Services. At a rapidly decreasing cost, these technologies are making it possible to overcome geographical, time, and organizational barriers to communication and knowledge transfer in dispersed networks.

Theory on how to successfully implement new ICTs to manage knowledge for DWs, however, is still in its infancy, and only anecdotal evidence about the best practices is available today. The challenge for management theory is, therefore, clear

that is, to provide empirically grounded and actionable knowledge for companies to design and implement new ICT enabled KM Systems able to extend the boundaries of their knowledge creation to their DWs. Based on an extensive study of DWs in Italy, this paper is a first attempt to draw implications on KMS requirements in mobile contexts.

The issue of managing the knowledge of a dispersed workforce has already been covered in economics and management literature, mainly in connection with the problems of preserving intellectual capital and competence from loss and spill over (Becker, 2001; Cramton, 2001; Maskell, 2001; Minkler, 1993; Tsoukas, 1996).

For example, Minkler (1993) focuses on firms that have tried to assess the importance of their dispersed knowledge; he emphasizes that some organizational innovations—employee participation, organization in cooperative teams, just-in-time stock management systems, forms of labor protection—are solutions that stem from firms' awareness of the dispersion of their knowledge assets.

The dispersion of knowledge exists in all organizations. However, in traditional companies, workers interact within the organizational physical boundaries, thus facilitating exchanges. In fact, the level of knowledge dispersion has progressively increased over the past few years, exceeding previous boundaries. Various factors contribute to this trend that is, the internalization of markets, companies are more widespread within areas, and product and service customization. In many cases, these factors induce firms to decrease the physical distances that separate them from their customers'/suppliers', by temporarily locating some employees in the customers'/suppliers' offices. In this context, the main problem is to create a technological and social infrastructure that allows the transfer of knowledge and information.

Different authors have pointed out that there are many relevant organizational and managerial effects resulting from the level of knowledge dispersion. Becker (2001) indicates three factors as the cause of organizational problems: large numbers, asymmetries, and uncertainty. He also identifies some strategies allowing a better use of dispersed knowledge:

- substitute knowledge with providing access to knowledge (not the knowledge itself, individuals have to remember where it can be found). The recovery takes place only when it is necessary.
- provide users with the capability of completing incomplete knowledge.

- design institutions with appropriate coordination mechanisms.
- decompose organizational units into smaller ones.
- increase the information available to the decision-maker.

Focusing on knowledge workers, Cramton (1997, 2001, 2002) identifies the problems that can occur when dispersed people communicate and collaborate: (1) failure to communicate and retain contextual information regarding different members, (2) interference between unevenly distributed information and team-level collaboration, (3) differences in evaluating the relevance of information, (4) differences in speed of access to information, and (5) difficulties in interpreting the meaning of silence/lack of communication. The main problems that may arise are: (i) the propensity to ascribe peoples' behavior or results to members instead of to the situation, (ii) decreased learning capacity, (iii) the incapacity to reach other members' expectations, and (iv) damaged interpersonal reliance.

Many authors have analyzed and proposed possible solutions to facilitate cooperation between mobile or geographically scattered workers or virtual teams (Cramton, 1997, 2001; Duarte and Snyder, 1999; Furst *et al.*, 1999; Lipnack and Stamps, 1997). The literature suggests that two aspects contribute to an effective management of distributed knowledge: an efficient communication/interaction structure (Cohen and Levinthal, 1990) and a focused human resources management system (Tsoukas, 1996).

Communication can be enabled by creating information channels, which are part of the social capital and can have a technological or an organizational nature (Gupta and Govindarajan, 2000; Nahapiet and Ghoshal, 1998). The introduction of job rotation is an example of an organizational solution, while the intranet and corporate portals are technological tools that facilitate the interaction among experts.

Many authors have focused their attention on the impact of KMS on performances (Haanes and Lowendhal, 1997; Petrash, 1996; Roos *et al.*, 1997; Schiuma and Marr, 2001; Sveiby, 1997). The impact on performances is strongly related to the approach adopted in the KMS (Davenport and Prusak, 1998; Wiig, 1997) and to the direct impact on organizational behavior in terms of knowledge creation, transfer, and capitalization.

A fundamental assumption that is common to recent literature is that coordination and decision making do not require knowledge centralization, but rather should provide the access to knowledge

(Nonaka, 1990). Simple access to knowledge still requires users to have both the competence and capacity for understanding, assimilating, and using retrieved knowledge. In addition, users should also be able to correct possible mistakes (Collins and Kusch, 1998), adapt knowledge to the specific problem and complete possible gaps (Nonaka and Takeuchi, 1995).

More recently, the concept of communities of practice emerged as a key issue. Communities of practice consist of people with a joint interest, mutual engagement, and a shared repertoire; they develop spontaneously outside the formal organization, can span organizational boundaries, create, and are based on relationships (Wenger and Snyder, 2000). The concept of community of practice has a strong potential when applied in the context of companies with DWs: by facilitating interaction within communities a company may reconnect its DWs to its social and cognitive system. However, literature on development and management of communities of practice is still based on a few anecdotal contributions based on the best practices.

Overall, current literature seems to focus on the problem of coping with knowledge dispersion, rather than on the phenomenon of managing DWs scattering; in particular, there is a lack of empirical research regarding its diffusion, characteristics, and effects on KMSs.

This article is organized as follows: in the next paragraph, the framework is introduced and the methodology for this research is described. The results are presented and analyzed in paragraphs 3 and 4; the limitation of this study and the plan for further research are finally discussed.

RESEARCH FRAMEWORK AND METHODOLOGY

This article is based on the results of an empirical research project which started in 2002 (Corso *et al.*, 2004) aimed at exploring the issue of KM in companies characterized by DWs. Our aim is to answer the following research questions:

RQ1. *Profiles and characteristics of DWs*

1.1 What is the relevance and profiles of DWs in Italian companies?

1.2 What are the characteristics of DWs in Italy?

RQ2. *KM approaches in dispersed environments*

Do the DW profiles drive the selection of the KM approaches?

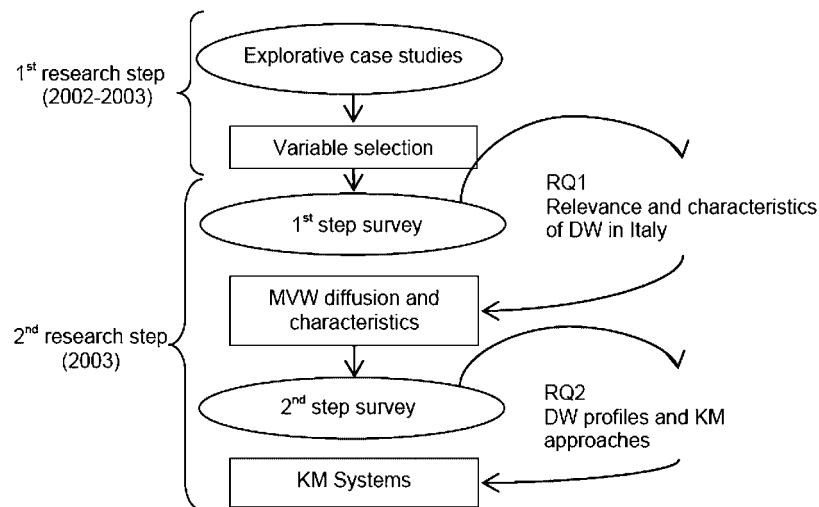


Figure 1 Research methodology

The project, funded by the Italian Ministry of Research, involved researchers from four universities and started with the development of six case studies that were used to explore the field and develop the framework for further explanatory research.

The lack of research and especially the lack of an empirically grounded analysis of DWs in Italy meant that the investigation had to be divided into two major phases (Figure 1):

- 1st research step. We conducted six explorative cases—not reported here—in order to identify the relevant variables of the phenomenon. Such variables have been used to build the research protocol for the survey.
- 2nd research step. We developed a two-step survey. The first—a telephone survey—measured how relevant dispersed work is in Italy (RQ1), while the second—a paper/electronic survey—

analyzed the DWs' activities and the KM tools used in the firms which declared to have DWs (RQ2). The telephone survey was based on a database of 1504 large and medium sized companies. Sampling was based on 2002 AIDA database (Bureau van Dijk); we were interested in large and medium sized enterprises in the manufacturing industries. Out of the 1504 companies contacted, 899 answered the survey (59.8% response rate), a sample that represents 36% of the overall relevant population. For the second step, the survey sample was made up of the people who declared to have DWs in the first step. Within the 899 firms which answered the survey, 410 stated that they have DWs (45.6%). These firms were sent a paper/electronic questionnaire: we obtained 83 answers (response rate 20.2%).

The investigation framework (Figure 2) was developed starting from the analysis of management literature and the available results from

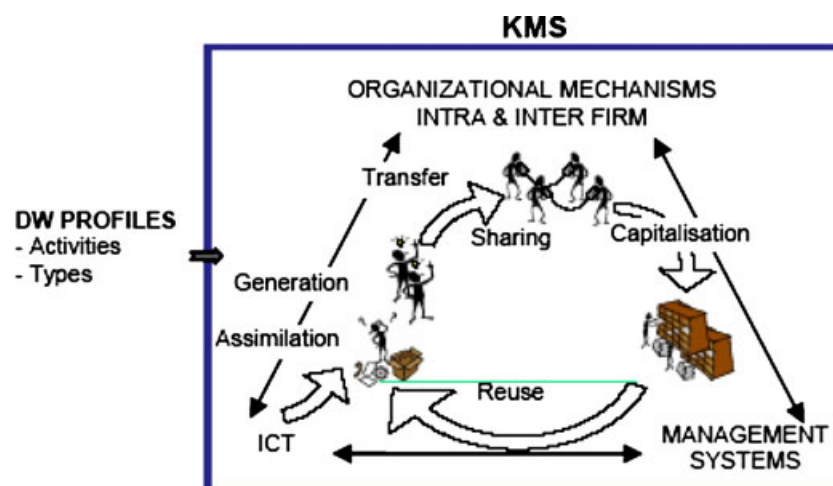


Figure 2 The investigation framework

previous research projects. Six exploratory cases were conducted to identify the key variables that appear to be relevant to understand the phenomenon.

Following a contingent approach, the investigation framework assumes that KMS effectiveness (in terms of the ability to produce good performance) depends on the internal coherence among choices (internal consistency) and on the adequacy with the contingent characteristics (Profiles) of DWs (external consistency).

Each group of variables has been analyzed and described, based on the results of exploratory studies. More exactly, for DW we referred to the worker who:

- is contractually linked to the firm and can be subjected to control by the firm and/or coordination;
- satisfies at least one of the following conditions:
- (s)he mainly works outside the firm. Employees always dislocated outside the firm (such as, in some cases, sales agents) and mobile workers who, despite having their own site in the firm, mainly work outside the firm (for example, consultants and maintenance people) are included;
- (s)he is an employee who works in a site with less than 10 employees.

DW Profiles were analyzed in terms of Type (the relationship with firm) and the Activity DW does (e.g., sales, maintenance, consulting). The DW Type is the result of a specific combination of variables, which describe the relationships which link dispersed workers to the firm. In particular, these relationships can be characterized by two groups of variables: *Space and Contractual Characteristics*, each encompassing two dimensions (Figure 3).

Space refers both to the physical, *Sp*, and the dynamic, *Sd*, dimensions. *Sp* identifies the place where the DW usually works: it can be the same

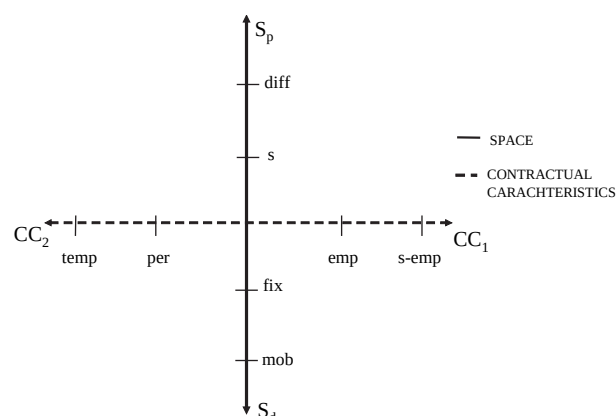


Figure 3 Relationship of DW to the firm

as the location of the company (s) or different from that (diff). *Sd* refers to how frequently the DW works in a certain place (s or diff): if a DW never changes his working place then his space is fix (fix), while, on the contrary, it is mobile (mob).

Finally, the *Contractual Characteristics* refer to both the contractual relationship nature—CC1—between the worker and the firm, employee (emp) or self-employer (s-emp), and the duration—CC2—of that relationship (permanent or temporary).

Depending on the combination of the variables related to the four dimensions, a DW Type can be identified. According to this definition, mobility is only one of the dimensions of worker's dispersion.

We adopted the definition of KM and KMS by Corso *et al.* (2004):

Knowledge Management (KM) is about creating an environment that encourages people to learn and share knowledge by aligning goals, integrating bits and pieces of information within and across organizational boundaries, and producing new knowledge that is usable and useful to the organization.

The Knowledge Management System (KMS) is the intended or emerging configuration of technical, organizational, and managerial choices which the company influences people's behavior with in all phases of the knowledge lifecycle, including the acquisition, transfer and sharing, capitalization and reuse of knowledge. KMS supporting knowledge processes (and their management, for that matter) therefore, exist and must be designed to fit the internal and external context of the organization.

DW PROFILES AND CHARACTERISTICS (RQ1)

DW profiles: which types?

Approximately 46% of the firms which answered the telephonic survey confirmed to having DWs but, in half of these cases, they represent less than 5% of the workforce (Table 1).

This data reflects the DW modular function: usually they do not answer to purely productive

Table 1 Frequency of DW percentages respect to the employee number

DW on total number of employees	< 5%	5%–10%	10%–30%	30%–60%	> 60%
% firms	53.2	22.8	16.5	3.8	3.8

Table 2 DW types

DW types	Space dimensions		Contractual characteristics		
	Physical	Dynamic	Contractual nature	Duration time	No. of firms
1	Different	Mobile	Selfemployer	Permanent	4
2	Different	Mobile	Employee	Temporary	3
3	Different	Mobile	Employee	Permanent	51
4	The Same	Fix	Employee	Permanent	3
5	Different	Fix	Employee	Permanent	8
6	The Same	Mobile	Employee	Permanent	1
7	Different	Mobile	Selfemployer	Temporary	1

needs, but they are the interface between the firm and the environment where it operates as they internalize part of the distance which separates the firms from their customers and suppliers. Table 2 shows the DW Types emerged as well as the number of firms they encompass.

The survey highlights how, with the exception of some isolated cases, there are only two 'consistent' configurations (in grey in Table 2 and Figure 4), both characterized by permanent and employed DW who works outside the company. The only differentiating variable between the two types is mobility.

Still, state-of-the art literature attributes also a relevant role to temporary and self-employer DWs. Such divergence can be justified by the fact that our analysis considers randomly distributed firms (in Italy), while the literature considers very intensive knowledge contexts.

The identified DW Types can be placed on an axis (Table 3), which has the classical forms of transaction regulation, at its extremes: the simple market relationships (or outsourcing) and the internalization of the relationship within the organization (fix, permanent, and internal employee).

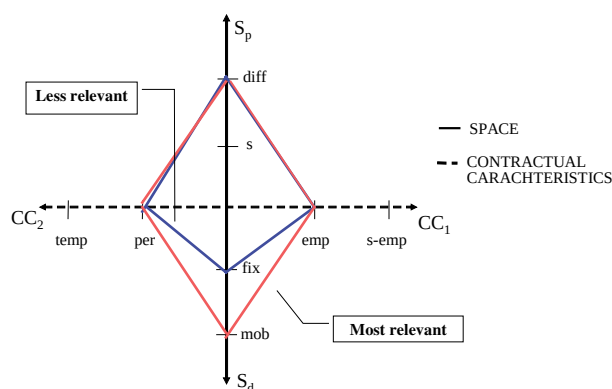


Figure 4 The most numerous types of DW

Table 3 DW and organizational boundaries

DW Types	Number of cases		
	1	10	20
Internal			
1	4		
2	5		
3	3		
4	2		
5	1		
External			

Today, dispersed work tends to adopt intermediate types.

DW profiles: which activities?

In the paper, questionnaire firms were required to describe the activity performed by DWs. The questionnaire was addressed to the previously interviewed person.

Three main Profiles of Dispersed Workers emerged (Figure 5):

- In 47% of the firms, the most relevant group of DWs are members of the sales force. In many cases these people, beside their commercial competence, also need technical competence regarding products and are engaged in some form of customer service;
- In 35% of the companies, DWs are mainly technicians, such as maintenance people or installers.

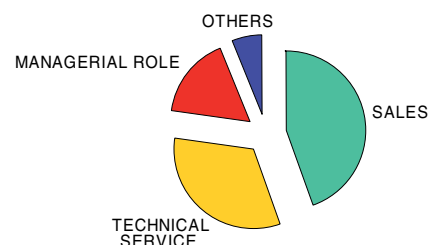


Figure 5 DW activities

Table 4 DW types and activities

		DW types							Total
		1	2	3	4	5	6	7	
DW activities	Sales	3	1	24	2				30
	Technical service	1	2	16	1	5	1	1	27
	Managers			11		3			14
	Total	4	3	51	3	8	1	1	71

Besides technical knowledge, in many cases, they also require complementary commercial competence;

- In the remaining 18% of firms, DWs are managers: researchers, plant directors, inspectors, or people responsible for affiliated units.

In five cases, DWs do not carry out intensive knowledge activities (for example, drivers or couriers).

The association analysis between Types and Activities is reported in Table 4.

DW characteristics

DWs mainly have a diploma. In the last few years, the presence of people with diplomas or degrees has increased, to the detriment of workers who simply attended the secondary school (Table 5).

Dispersed workers present particularly low turnover levels: less than 3% in 75% of the firms, and less than 8% in 96% of the firms. Still, it should be noted that during the period of analysis, the mean and general level of turnover was particularly low.

The main causes of turnover are both high market demand of such figures and old age. Turnover causes are the same in all the firms, regardless of the level of turnover they have, except for the cause connected to the high market demand, which is far more critical for those organizations which have a high turnover. Hence, the lack of such figures,

compared to the high demand, seems to generate higher turnover levels. The most critical problems connected to turn-over are: cost of training new personnel, risk that the employee works autonomously or is hired by a competitor (spin-off), and difficulty in finding new human resources.

Lastly, there is a growing statistically significant relationship between the costs of newly hired people and the spin-off of the employees. This fact highlights how the criticality played by the training costs is linked to the concern that an employee leaves the firm soon after the training. Notwithstanding that experience is required for 80% of DWs to be hired, only 16.5% of the firms think that the majority of newly hired people do not need training. Hiring of trained personnel is more frequent in the case of the sales-force, compared to the other typologies. More than one firm out of four develops training courses and 43% of companies draw paths of partnership with more experienced colleagues for the greatest part of the newly hired people.

Training courses for professional updating are also organized for previously hired DWs. About 62% of DWs attends at least one course per year.

In 68% of cases, technical knowledge regarding product/service is fundamental. In more than half of the cases, relational capabilities with customers and/or other organizational operative units were considered to be critical. For more than 50% of firms, knowledge regarding markets and customers plays a critical role for DW.

Table 5 Education degree of DW in general and of the DW hired in the last two years

	% Degree	% Diploma	% Secondary school
Mean percentages of DW	20.06	63.30	16.64
Mean percentages of DW hired in the last two years	23.1	70.5	6.4

DW PROFILES AND KM APPROACHES (RQ2)

Theoretical background

In order to answer to RQ2, we used the Perrow model (1967) of technology and structure, as it describes, for different task environments, the structural arrangements necessary to achieve effective control and coordination. Hence, such a model

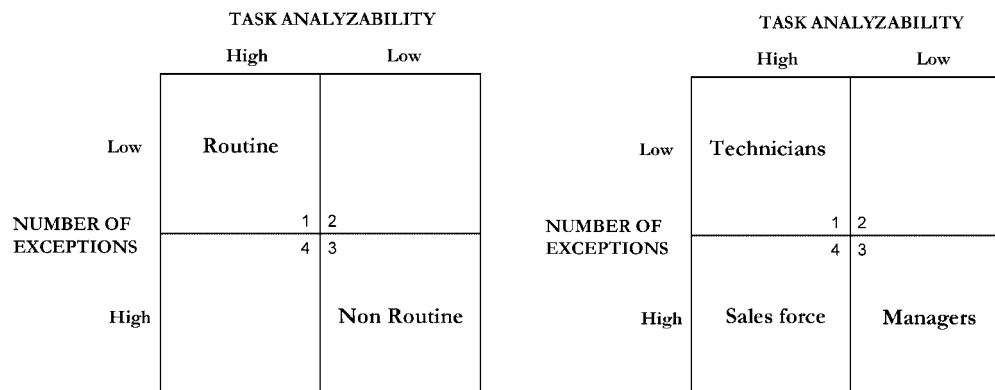


Figure 6 the Perrow model of technology and structure

was used in order to formulate the hypotheses regarding the characteristics of the KMS that better suit each specific situation in terms of DW activities—technicians, sales force, and managers.

The Perrow model highlights two key dimensions in order to describe a task (Figure 6): the existence (or otherwise) of well-established techniques for performing tasks (task analyzability), and the degree of variety in the tasks encountered (number of exceptions). The two dimensions are commonly, and collectively, referred to as task uncertainty.

Tasks in Cell 1 are repetitive and familiar (few exceptions), with known routines for handling them (high analyzability): the task setting is 'routine.' The activities of field force technicians can be regarded as a 'routine' situation. According to Perrow, organizations facing such tasks would be able to rely on procedure guides, operating manuals, job codification, rigid lines of reporting, and accountability to control employee's behavior. We can, therefore, formulate the following hypothesis:

Hyp. 1: KMS for field force technicians are based on procedure guides, operation manuals, task codification, and rigid lines of reporting for controlling employee behavior.

In contrast, task settings characterized by the absence of established techniques for handling tasks (low analyzability), and the existence of substantial variety or novelty in the tasks encountered (high number of exceptions), are described as 'non-routine' (Cell 3). The consulting process is characterized by low repetitiveness of activities, absence of standardized procedures and practices, and unavailability of a clear body of knowledge which can guide the work. According to the Perrow model, the consultancy task represents a 'non-routine' situation. It is here that Perrow expects that formal, bureaucratic controls will not be effective in controlling performance. Tasks cannot be

'programmed' and thus, behavior cannot be controlled by implementing procedures which pre-specify desired actions or by monitoring individual actions through the use of supervisors. Perrow argues that 'collegial' structural arrangements are required in these settings. We can, therefore, formulate the following hypothesis:

Hyp. 2: KMS for managers should not be based on formal and bureaucratic controls (procedure guides and operating manuals) and/or the use of superior authority to monitor individual actions.

The remaining two situations in Figure 6 (Cells 2 and 4) involve task settings where it is more difficult to predict which forms of control will prove most effective. Tasks may have little variety, yet exhibit uncertainty in the transformation process (Cell 2); others may have little uncertainty but a great deal of variety (Cell 4). They are in the middle of the routine/non-routine continuum, but they are not the same. Considering Cell 2, tasks here are low in variety suggesting the potential suitability of behavior controls (i.e., fine glassware). However, notwithstanding the lack of variety of tasks, little has been learned about the process by which inputs are transformed into outputs; programs for performing these tasks have not been established (i.e., analyzability is low). It is, therefore, not possible to develop a set of manuals, guides, or procedures which can be drawn upon during task execution.

In Cell 4, much variety is encountered in tasks however, input-output relations can be readily specified (i.e., made-to-order machine, civil engineering): this is the task setting of the sales force. This enables the development and implementation of programmed controls, such as procedure guidelines and operating manuals, and/or the use of superior authority to ensure that behavior is in accordance with what is known to achieve the

desired results. We can, therefore, formulate the following hypothesis:

Hyp. 3: KMS for sales force are based on non pre-determined procedures and person-to-person communication.

In order to test these three hypotheses, we carried out an association analysis between DW activities (managers, sales force, and field force technicians) and the KM approaches adopted by companies to manage DWs knowledge identified by cluster analysis.

KM approaches

The most up-to-date literature and the explorative case studies provide evidence that the main problems connected to KM for DWs are as follows:

— knowledge transfer

- Retrieval of knowledge from organizational knowledge storage banks (i) training on the job, (ii) in case of problems, workers (a) use manuals, (b) contact experts, (c) use customer/supplier records, (d) use project database).
- Feedback from DWs to update knowledge domains (sharing of knowledge, reports).

— Planning and control of DW activities

- DW activity planning (autonomous vs. hierarchical planning).
- DW activity control (reports, performance measurement, results measurement).

These aspects were used as inputs in cluster analysis in order to identify the emerging approaches used by companies to manage DW knowledge. More exactly, in order to identify the most appropriate number of clusters, a series of hierarchical clusters were created. Because of the high number of isolated cases, four clusters were used to allow four differentiating types of behavior and to provide a reasonable number of clusters. After the number of clusters was decided upon, some k-means clustering was carried out; four KM approaches emerged (Table 6):

- *Products/services innovation orientation.* Tasks are partially repetitive: retrieval of knowledge is important and frequent, and hence supported by all the investigated tools. In particular, manuals and project databases allow the recovery of explicit knowledge, while expert networks support the recovery of tacit knowledge. Feedback is important for updating knowledge capital that is achieved through reports. Workers are partially autonomous; therefore, the adoption of

a control and an incentive system, mostly based on performance measures and reports, is important.

- *Process standardization orientation.* Processes are easily analyzed and tasks repetitive. Therefore, the retrieval of knowledge is not frequent and training is mainly on the job. New problems or exceptions are not frequent, but when they do occur, DWs examine manuals or contact experts; capitalization and sharing of knowledge generated when the rare exceptions take place, which is strongly encouraged (reports). Activities are planned by the company and results can be easily controlled, by means of reports.
- *Performance control orientation.* DWs independently manage their non-repetitive activities. The retrieval mainly involves knowledge and information about customers and suppliers (which is useful to analyze the specific problem and to develop a customized solution) and experts are the main source. For the characteristics of tasks, the company cannot fully plan DW activities. Therefore, incentives are based on individual results. In these contexts, KM is mainly focused on control (by individual performance measures), but also supports informal networks.
- *Knowledge sharing orientation.* Context and problems are variable and the company cannot hierarchically plan DW activities and use KMS in order to control DWs and measure their results. Knowledge is mainly tacit: it cannot be memorized in manuals or other physical supports, because tasks are not repetitive, training on the job is not really useful. Experience is the most important requirement for DWs, and for this reason expert networks are a fundamental resource in solving complex problems. The tacit form of knowledge inhibits adoption of formal incentive schemes for the sharing of knowledge. Sharing is achieved in informal networks: systems are very important for identifying the right person to contact. Companies use their broad knowledge and customer and supplier records to analyze a specific problem and to develop a customized solution.

Associating DW profiles and KM approaches

The association analysis between the specific DW Activities and the KM approaches (Table 7) points out that:

- technicians (more than 50% are Type 3 and more than 75% are mobile), mainly adopt the KM oriented to process standardization.

Table 6 Emergent KM approach in dispersed work environments

Problems	KM approaches oriented to			
	Products/services innovation	Processes standardization	Performance control	Knowledge sharing
Knowledge retrieval in case of exceptions	Exceptions are frequent: workers frequently use manuals, experts, and records	Workers rarely face new problems. In these rare cases, they use manuals, experts, and project databases. Information concerning customers and suppliers is not usually useful	New problems are very frequent. Because of the nature of both knowledge and activities, workers get knowledge from experts. Customer and supplier records are also useful to analyze specific problems	Knowledge is complex and tacit knowledge and is capitalized by experts. Customers and suppliers' records are important for customizing solutions
Feedback for the company	Reports are used for creating an organizational memory about customers and suppliers, rather than for controlling purposes. This memory is useful for adapting solutions to customer specifications	Reports are useful for both control and identification of new problems and updating manuals and databases when DW faces the rare exceptions	Tacit form of knowledge and the lack of task repetitiveness do not allow the creation of a company memory. Knowledge resides in individuals	Knowledge is shared spontaneously through informal networks of experts. Reports allow the identification of experts
Activity planning	As activities are only partly repetitive, DW tasks are only partly planned by the company in a hierarchical way	Activities are repetitive, so tasks are planned by the company	As activities are not repetitive, companies cannot plan tasks of DWs who, indeed, are autonomous	DWs are partially autonomous
Activity control	The control of partially autonomous workers is achieved with performance measures and reports	Tasks are hierarchically planned; therefore, control can be achieved using only reports. Result measures check only group activities and performance measures are not defined	Individual performance measures are used to control DWs	DWs are not controlled, although the submitting of reports is required

Table 7 DW activities and KM approaches

		KM approaches oriented to				
		Products/services customization	Processes standardization	Performance control	Sharing	Total
DW activities	Sales force	19	4	8	2	33
	Technicians	6	11	—	4	21
	Manager	1	2	5	3	11
	Total	26	17	13	9	65

- managers (almost all are Type 3) are mainly associated with KM oriented to performance control.
- sales forces, which are mainly mobile (Type 3), use KM oriented to product/service innovation.

The survey results seem to confirm our hypotheses: there are observable relationships between DW types and KM approaches.

IMPLICATIONS FOR MANAGEMENT ACTION AND FURTHER RESEARCH

This paper aimed at understanding the state of dispersed work in Italy and exploring the relations between DW activities and KM approaches, using an empirical, survey-based study.

The problem is real as DWs represent an increasingly relevant share of the total workforce and traditional management systems are not designed to answer their needs. In this situation, it is crucial to provide empirically grounded and actionable knowledge in order to design and implement ad-hoc KM Systems to extend the companies knowledge creation boundaries to their DWs.

The survey results confirm the Perrow model of technology and structure and therefore, we believe that this study is a good starting point for the future development of this research with the aim of tailoring guidelines for KMS design. Additional explanatory case studies are needed to better underpin the cause and effect links between the Profiles and the KM Approaches, as well as to explore the impact of these different Approaches on worker satisfaction.

REFERENCES

- Becker MC. 2001. Managing dispersed knowledge: organizational problems, managerial strategies, and their effectiveness. *Journal of Management Studies* 38(7): 1037–1051.
- Cohen WM, Levinthal DA. 1990. Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly* 35: 128–152.
- Collins H, Kusch M. 1998. *The Shape of Actions—What Humans and Machines can do*. MIT Press: Cambridge/MA.
- Corso M, Martini A, Paolucci E, Pellegrini L. 2004. Knowledge management systems in continuous product innovation. In *Intelligent Knowledge-Based Systems. Business and Technology in the New Millennium*, Leondes CT (ed.). Volume 1 (Knowledge-Based Systems), Chapter 2. Kluwer Academic Press: Dordrecht, NL; 36–66.
- Cramton CD. 1997. Information problems in dispersed teams. *Academy of Management Best Paper Proceedings*; 298–302.
- Cramton CD. 2001. The mutual knowledge problem and its consequences for dispersed collaboration. *Organization Science* 12: 346–371.
- Cramton CD. 2002. Finding common ground in dispersed collaboration. *Organizational Dynamics* 30(4): 356–367.
- Drucker P. 2002. They're not employees, they're people. *Harvard Business Review*. 2(February): 70–77.
- Davenport T, Prusak L. 1998. *Working Knowledge: How Organizations Manage What They Know*. HBS Press: Boston.
- Duarte DL, Snyder NT. 1999. *Mastering Virtual Teams*. Jossey-Bass: San Francisco.
- Furst SR, Blackburn D, Rosen B. 1999. Virtual teams: a proposed research agenda. *Information Systems Journal* 9(4): 249–269.
- Gupta AK, Govindarajan V. 2000. Knowledge management's social dimension: lessons from Nucor steel. *Sloan Management Review* 42(1): 71–80.
- Haanes K, Lowendhal B. 1997. *The Unit of Activity: Towards an Alternative to the Theories of the Firm. Strategy, Culture and Style*. John Wiley and Sons: London.
- Lipnack J, Stamps J. 1997. *Virtual Teams: Working Across Space, Time, and Organizations*. John Wiley & Sons: New York.
- Laubacher R, Malone TW. 2003. Retreat of the firm and the rise of guilds: the employment relationship in an age of virtual business. In *Inventing the Organization of the 21st Century*, Malone TW, Laubacher R, Scott-Morton MS (eds). MIT Press: Boston.
- Maskell P. 2001. Knowledge creation and diffusion in geographic clusters. *International Journal of Innovation Management* 5(2): 213–237.
- Minkler AP. 1993. The problem with dispersed knowledge: firms in theory and practice. *Kyklos* 46(4): 569–587.

- Nahapiet J, Ghoshal S. 1998. Social capital, intellectual capital and the organizational advantage. *The Academy of Management Review* **23**(2): 242–266.
- Nonaka I. 1990. Redundant, overlapping organization: a Japanese approach to managing the innovation process. *California Management Review* **32**(3): 27–38.
- Nonaka I, Takeuchi H. 1995. *The Knowledge Creating Company*. Oxford University Press: Oxford.
- Perrow C. 1967. A framework for the comparative analysis of organizations. *American Sociological Review* **32**(2): 194–208.
- Petrash G. 1996. Dow's journey to a knowledge value management culture. *European Management Journal* **14**: 365–373.
- Roos J, Roos G, Dragonetti N, Edvinsson L. 1997. *Intellectual Capital: Navigating in the New Business Landscape*. Macmillan: London.
- Schiama G, Marr B. 2001. Measuring and managing intellectual capital and knowledge assets in new economy organizations. In *Performance Measurement Handbook*, Bourne M (ed.). GEE Publishing Ltd.: London, UK.
- Sveiby K. 1997. *The New Organizational Wealth: Managing and Measuring Knowledge Based Assets*. Barret-Kohler Publishers: San Francisco.
- Tsoukas H. 1996. The firm as a distributed knowledge system: a constructionist approach. *Strategic Management Journal* **17**: 11–15.
- Wenger EC, Snyder WM. 2000. Communities of practice. The organizational frontier. *Harvard Business Review*. **1**(January/February): 139–145.
- Wiig K. 1997. Integrating intellectual capital and knowledge management. *Long Range Planning* **30**: 399–405.

Copyright of *Knowledge & Process Management* is the property of John Wiley & Sons, Inc. / Business and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.